Extra Corporal Shock Wave Lithotripsy of Bile Duct Stones: Absence of Short Term Complications with the use of Very High Number of Shock Waves

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Abstract

Extracorporeal shock wave lithotripsy (ESWL), generated by the Siemens Lithostar (Lithostar), was used in six patients (two males, four females; aged 26 to 76 years) with large bile duct stones (diameter 16 mm to 30 mm; single in five, multiple in one) in whom routine endoscopic measures had failed. Disintegration of stones was achieved in four patients. The mean number of shocks delivered per patient, at energy levels generated by 19 kv, was 18,267 (range 4200-35,000) over 1 to 8 sessions, with a maximum of 6000 shocks per session. Exacerbation of cholangitis occurred in one patient after stone disintegration. Cutaneous petechiae were noted in four patients. Our report describes the use of a very high number of shock waves in the treatment of bile duct stones, with no appreciable short term complications noted in this small experience. Our initial experience of treating large bile duct stones with ESWL appears encouraging and safe.

Key words: Gallstones, common bile duct, calculi.

Introduction

Several non-surgical procedures are being evaluated for the treatment of common bile duct (CBD) stones that are too large for extraction by routine endoscopic measures. Mechanical,1 laser,2 and direct electrohydraulic3 lithotripsy have all been evaluated in small numbers of patients; these require close contact of the probe with the stone to ensure efficacy, demand high degrees of technical skill and have not become widely available. Chemical dissolution of stones by infusion of solvents is time consuming, is effective only for cholesterol stones, has a poor success rate, and is associated with nausea and diarrhea in up to 40% of patients.4

Extracorporeal shock wave lithotripsy (ESWL) has recently emerged as a safe, easy and effective treatment modality for renal and gallbladder calculi. This technique has also been applied to the treatment of bile duct stones and has been shown to achieve fragmentation in 70% - 86%.4 With negligible risk, obviating surgery which has a mortality rate of 6-8% especially in the elderly,5 we report our initial experience with ESWL in the management of patients with bile duct calculi which were not amenable to extraction by routine endoscopic measures. This is the first such report from India.

Material and Methods

From January 1989 to June 1990, 68 patients were referred to our center for endoscopic removal of bile duct stones. Of these, 48 had undergone prior cholecystectomy and had retained or recurrent bile duct stones, eight had CBD calculi with stone-free gallbladders in situ, and twelve had bile duct calculi with concomitant gallbladder calculi. In 54 (84%) patients the stones were extracted after endoscopic papilotomy. In 14 patients CBD stones could not be extracted by routine endoscopic measures because of very large size (>20 mm diameter) in 10 patients and moderately large size (13-20 mm) with small papillae in 4 patients. These 14 patients were offered ESWL; eight of these refused ESWL due to the high cost of treatment.

Six patients (2 males, 4 females; aged 26-76 years) underwent ESWL therapy; four had exclusively large (25-30 mm) and two had moderately large (16 mm) stones with small papillae where endoscopic extraction had failed. Five patients had solitary stones while multiple (two) stones were found in one. One of these patients had Dormia impaction while attempting stone extraction after endoscopic papilotomy. Three patients had previous cholecystectomy whereas three had stone free gallbladders in situ. Recurrent pain, jaundice and cholangitis were the presenting problems in all six patients. Stone localization was achieved by Dormia basket in two patients and by contrast injection via endoscopic nasobiliary tube in the other four patients.

Administration of Extracorporeal Shock Waves

ESWL was performed with the Lithostar (Siemens, Erlangen, West Germany) in which shock waves are generated by an electromagnetic membrane which compresses a waterbath inside the machine. The shock waves are focussed by an acoustic lens and transmitted through a flexible membrane and a gel into the body of the patient lying in the prone position. Immersion of the patient in a waterbath was not required. No anesthesia or analgesia was required.

Endoscopic retrograde cholangiopancreatography was performed in all the patients, followed by endoscopic papilotomy which achieved a cut of 10-16 mm. CBD calculi were localized by grasping in a Dormia basket in the first two cases and by placing a nasobiliary tube for infusion of contrast medium in four patients.
Positioning of calculi in the shock wave focus as well as monitoring of stone fragmentation was accomplished by biplane fluoroscopy. Shock waves generated at an energy level of 19 kV and triggered by the electrocardiogram were delivered till stone fragmentation was achieved or 5000-6000 shocks were delivered in one session over a period of 40 minutes. Patients received no more than one session in 24 hours, for a total of up to 8 sessions. Treatment was considered successful and discontinued when the largest fragment was <8 mm diameter and considered extractable by endoscopic basketing.

Results
Stone fragmentation was achieved in four patients including one with multiple stones. The mean size of stones in these patients (largest when more than one) was 23.6 mm (range 16 to 30). The mean number of shocks required for fragmentation of stones was 20,000 (range 4200 to 39,000, given in over 1-5 sessions) at 19 kV energy. Extraction of fragments (5-8 mm) by endoscopic basketing was performed in 3 of the 4 patients while in the other patient fragments passed out spontaneously. Of the two patients in whom ESWL was considered to have failed (stone size 16 and 30 mm and shock waves given 6000 and 22,000), one underwent a repeat attempt at endoscopic stone extraction by extension of papillotomy, which was successful. The remaining patient underwent surgery for stone removal.

There was no mortality in these six patients. Exacerbation of cholangitis occurred in one patient after stone fragmentation with ESWL; this responded to conservative treatment. Nasobiliary drain had not been used in this patient. Cutaneous erythema and petechiae were noted in four patients. No hematuria or hyperamylasemia was noted in any patient. The nature of stones could be determined in four (fragments in 3, stone removed at surgery in one) of the six patients. Two of 3 cholesterol stones and one brown pigment stone had successful fragmentation.

Discussion
We have shown that ESWL is an effective method of treatment for bile duct calculi which could not be removed endoscopically. Although our experience is small, moderate success was achieved for large CBD calculi. While fragmentation was not achieved in two of our six patients, we feel that in one patient ESWL was probably not given an adequate trial. The other patient whose stone was very large (30 mm) was indeed truly resistant to ESWL as fragmentation was not achieved even after 22,000 shocks. It would perhaps be appropriate to count this single case as a true failure, i.e. a rate of 17%.

Shock wave therapy was performed with the Lithostar (Siemens) machine used routinely for renal lithotripsy. As this machine uses fluoroscopy for localising stones and as bile duct stones are usually radiolucent, an adjuvant method was used to localize the stones for targeting. In the first two patients this was done by grasping the stone in a Dormia basket after endoscopic papillotomy, the shock waves being focussed on the radio-opaque wire basket. One of these two patients

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in fact had an impaction of the basket with the stone while attempting extraction. In the subsequent four patients endoscopic nasobiliary drainage tube was inserted after papilotomy on the first day, followed the next day by ESWL. Contrast solution was infused through the tube to localise the stone for ESWL. Since this technique provided adequate bile drainage as well, cholangitis was not noted in these four patients during treatment. We would prefer routine use of endoscopic nasobiliary tube to Dormia basketing for targeting of stones.

Several workers have noted the poor response to ESWL with increasing stone size. Around 10% of patients with choledocholithiasis, in several series from the West, have large stones not amenable to endoscopic extraction. At our center, where referrals are late and duration of symptoms long, around 30% of patients with CBD stones seem to have such large calculi. We believe that it is in this group of patients that ESWL would have to show its predominant role although its high cost and poor availability may prove to be a deterrent to its use.

Biliary calculi are more difficult to fragment with ESWL than renal calculi. This is borne out by the lower fragmentation rate (70-86%) for biliary calculi compared with 97% for renal calculi as well as the higher number of shocks and high energy levels required to fragment bile duct stones (19 kV vs 15 kV for renal calculi). The number of shocks used by us (mean 18,267, max 39,000) was however far in excess of what is reported by Sauerbruch et al using the Dornier lithotripter (mean 2867) and also that used by Staritz et al using the Lithostar machine (max 7500). We were cautious in using large number of shocks in our earlier patients and repeated the sessions at 2-6 days intervals when several sessions were required. No serious complication attributable to soft tissue trauma during ESWL was however noted by us. Investigations are in progress to determine why CBD stones in Indian patients are so resistant to fragmenta-

tion by ESWL compared to that reported from the West.

Though small, our experience suggests that ESWL is a safe, quick and effective method of treatment of bile duct stones where routine endoscopic measures fail. The high cost of treatment would limit its availability and use in India. Criteria for selecting patients likely to respond to ESWL need to be defined. Also, the rate of long term consequences of unrecognized soft tissue trauma (like late development of bile duct strictures, pancreatitis) would need to be ascertained before recommending its widespread use.

References

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